1,001,515

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,001,515

Inventors: RAYMOND JOHN DAVIES and WILLIAM HAMMOND BRICKNELL

Date of filing Complete Specification: June 19, 1962.

Application Date: June 27, 1961. No. 23138/61.

(Patent of Addition to No. 935,831 dated Jan. 27, 1960).

Complete Specification Published: Aug. 18, 1965.

Index at acceptance:—F2 S8M1B

Int. Cl.:—F 06 f

COMPLETE SPECIFICATION

Improvements in Fluid Springs

We, DUNLOP RUBBER COMPANY LIMITED, a British Company of 1, Albany Street, London, N.W.1., do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to fluid springs of the type comprising a flexible envelope formed at one end as a bellows and at the other as a rolling lobe diaphragm and is an improvement in or modification of the invention described in the specification of U.K. Patent No. 935,831.

One major difficulty which sometimes arises when converting vehicles with leaf spring suspension systems to fluid spring suspension systems is the fact that the fluid spring cannot be conveniently attached to the frame of the vehicle due to the presence of frame members or other obstructions which prevent access to the top of the fluid spring.

The object of the present invention is to provide a fluid spring wherein the above problem is largely overcome.

According to the present invention a fluid spring assembly comprises a pair of relatively displaceable mounting members, a flexible annular envelope connected at one end to one of the two members and at the other end to the other of the two members and being formed in the region of the one end thereof into a single or multiple convolution bellows and in the region of the other end into a rolling lobe arranged to roll in the direction of the relative displacement of the members to permit compression and expansion of the spring, the one end of the envelope being provided with a beaded edge which is fluid-tightly trapped between an annular boss extending axially from the one mounting member into the envelope and a frusto-conical member detachably secured to the one mounting member and surrounding the beaded edge of the envelope, the frusto-conical member having a flared skirt extending from its inner periphery towards the other mounting member.

Preferably the outer surface of the annular boss is formed with a slight inward taper towards the adjacent bead of the flexible envelope and the frusto-conical member traps the end of said bead between itself and the said tapered outer surface of the boss with an increasing pressure due to said taper when the frusto-conical member is detachably secured to the mounting member.

A particular embodiment of a fluid spring according to the present invention will now be described with reference to the accompanying drawing which illustrates an annular flexible envelope 10 formed with an upper convoluted portion 11 and a lower rolling lobe diaphragm portion 12. The ends of the envelope 10 are provided with beads 13 and 14 which may be reinforced with annular bead wires 15 and 16 of circular cross-section. An inextensible ring 17 is positioned between the beads 13 and 14 at a waisted portion 18 of the flexible envelope 10 between the portions 11 and 12. The diameter of the lower bead 14 is substantially smaller than that of the waisted portion 18 so that the said bead 14 may pass completely through said waisted portion 18.

The lower bead 14 is fluid-tightly retained in a bead seat 19 on an upstanding pedestal 20 by a dished clamping plate 21. The clamping plate 21 is tightened onto the bead 14 by bolts 22 screwed into the pedestal 20, which is secured to an axle (not shown) of the vehicle by any convenient means and tapers outwardly from its upper end adjacent the bead seat 19 to its lower end 23 to increase the effective area of the lower rolling lobe diaphragm portion 12 when the spring is compressed.

The upper bead 13 is fluid-tightly secured

[Price 4s. 6d.]

to a mounting member 24 which is attached to or forms part of the frame of the vehicle and which is provided with a connection (not shown) through which air pressure may be supplied to the interior of the envelope 10. A downwardly projecting hollow boss 25 is formed on the mounting member 24 and has a radial outer surface 26 which tapers inwardly towards its lower end 27. A frusto-conical member which surrounds the bead 13 comprises an annular plate 28 secured to the mounting member 24 by a series of bolts 29. The annular plate 28 is provided at its inner periphery with a frusto-conical portion 30 which extends obliquely downwards and has a skirt portion 31 extending from its inner periphery. The upper bead 13 of the envelope 10 is secured by trapping it between the said frusto-conical portion 30 and the tapering outer surface 26 of the hollow boss 25 and thence, by tightening the bolts 29, the bead 13 is squeezed into fluid-tight relationship with both the hollow boss 25 and the frusto-conical portion 30.

The spring is assembled by first securing the lower bead 14 within the bead seat 19, fitting the clamping plate 21 in place and tightening the bolts 22 onto said clamping plate 21 with a suitable tool inserted into the envelope 10. The upper bead 13 is subsequently positioned around the hollow boss 25 and trapped by the frusto-conical member 30 as previously stated. The bolts 29 which secure the frusto-conical member 30 are tightened from outside the spring and from the under surface of the mounting member 24.

The skirt portion 31 has the two-fold purpose of shortening the effective length of the lobe of the convolution 11 and of pressing the said convolution 11 away from the locality of the annular plate 28 so that a spanner can be effectively applied to the bolts 29.

The advantage of the mounting arrangement described herein is that there is no need for access to the top of the mounting member 24 to be provided. This is of particular importance when fluid springs are desired to be fitted in place of existing leaf springs and access to the top mounting member is difficult or impossible.

The advantage in the modification of the shape of the spring, compared with that described in our U.K. Patent Specification No. 935,831, is that it does not need to be accurately aligned when assembled to the vehicle and normal chassis manufacturing tolerances are adequate. Moreover, to avoid cracking of the rubber, the spring utilizes a short stroke lower rolling lobe diaphragm portion, additional stroke requirements being catered for by the bellows-type upper convolution. Furthermore whereas the prior construction had a retaining skirt to obtain the desired load/deflection characteristic and the piston contracted the rubber adjacent to the centre ring to enable the upper convolution to be compressed similar results are now obtained by shaping the piston and allowing it to pass through the centre ring. The piston shape creates an increase in the effective area of the lower portion when the spring is compressed and as the effective areas of the upper and lower portions must be equal to one another for the spring to remain in equilibrium, the upper convolution automatically adjusts itself to the change by a reduction in length and a similar effective area increase.

WHAT WE CLAIM IS:—

1. A fluid spring assembly comprising a pair of relatively displaceable mounting members, a flexible annular envelope connected at one end to one of the two members and at the other end to the other of the two members and being formed in the region of the one end thereof into a single or multiple convolution bellows and in the region of the other end into a rolling lobe arranged to roll in the direction of the relative displacement of the members to permit compression and expansion of the spring, the one end of the envelope being provided with a beaded edge which is fluid-tightly trapped between an annular boss extending axially from the one mounting member into the envelope and a frusto-conical member detachably secured to the one mounting member and surrounding the beaded edge of the envelope, the frusto-conical member having a flared skirt extending from its inner periphery towards the other mounting member.

2. A fluid spring assembly according to claim 1 wherein the outer surface of the annular boss is formed with a slight inward taper towards the adjacent bead of the flexible envelope, and the frusto-conical member traps the end of said bead between itself and the said tapered outer surface of the boss with an increasing pressure due to said taper when the frusto-conical member is detachably secured to the mounting member.

3. A fluid spring assembly according to claims 1 or 2 wherein the mounting member and the frusto-conical member are detachably secured together by bolts which can be tightened from the lower side of the mounting member and outside the flexible envelope.

4. A fluid spring assembly according to claim 3 wherein the flared skirt provided at the inner periphery of the frusto-conical member supports the upper convolution of the flexible envelope.

5. A fluid spring assembly according to any preceding claim wherein the flexible annular envelope has an upper convoluted portion, an intermediate waisted portion and a lower rolling lobe diaphragm portion having a lower beaded edge which is considerably smaller than the diameter of the waisted portion.

6. A fluid spring assembly substantially as herein described with reference to the accompanying drawing.

C. H. BOWYER,
Agent for the Applicants.

Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press (Leamington) Ltd.—1965. Published by The Patent Office, 25 Southampton Buildings, London, W.C.2, from which copies may be obtained.

Walter Ottesen
Patent Attorney
P.O. Box 4026
Gaithersburg, MD 20885-4026

Telephone: 301-869-8950
Telefax: 301-869-8929

Attorney Docket No. 202-093
Application Serial No. 10/693,495

1,001,515
1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.